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THE REACTION OF WHEAT, CORN AND SOYBEAN FUTURES PRICES TO USDA'S EXPORT INSPECTIONS REPORT

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ABSTRACT

USDA's weekly Export Inspections Report is found to provide only limited information to the market over the period from 1988 through 1991. Wheat futures prices did not react to the unanticipated information in the report, while corn and soybean futures prices reacted significantly only during two of the five marketing years contained within the study period. This finding suggest that the Export Report Inspections may be redundant in the sense that its informational value has already been provided by the requirement that large export sales be reported daily.

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To alleviate concerns about the potential for grain trading companies to make abnormal profits from their information regarding export sales, the U.S. Department of Agriculture (USDA) maintains a three-tiered reporting system for export sales. The three tiers involve (1) reporting of large sales within 24 hours, currently reported by USDA in press releases, (2) weekly release of export sales, currently reported on Thursday by the Foreign Agricultural Service, and (3) weekly release of export inspections, currently reported on Mondays by the Agricultural Marketing Service.[1]

Conklin, and Patterson and Brorsen examine market reactions to the Export Sales Report. Conklin finds that wheat, corn, and soybean futures prices reacted significantly to the release of this report over the period from June 1975 to June 1980. In contrast, Patterson and Brorsen find only weak evidence that cotton, soybean, and wheat futures prices reacted to the Export Sales Report over the period from August 1980 through August 1990. Hence, the evidence is mixed regarding whether the Export Sales Report provides the market with new information.

No study has investigated futures price reactions, and hence informational value, of the Export Inspections Report. The Export Inspections Report contains information on the quantities of wheat, corn, and soybeans which are loaded on ships at U.S. ports for export.

This study investigates whether the Export Inspections Report provides new information to commodity markets. Following the methodology used by Colling and Irwin, Grunewald, McNulty and Biere, and others, survey data of market traders are used to proxy market expectations of the reported

inspections. This procedure allows the identification of anticipated and unanticipated export inspections. In an efficient market, prices respond only to new, i.e. unanticipated, information (Fama).

The next section describes the data used in the study. Following sections contain analyses of the properties of the expectations and the reaction of futures prices to the release of the Export Inspections Report. Conclusions and implications end the paper.

DATA

USDA's Federal Grain Inspection Service determines the amount of wheat, corn, and soybeans that are loaded at various ports. This information is relayed to Washington D.C. where the Agricultural Marketing Service compiles the information. The inspections are released publicly in the Grain and Feed Market News report at 2:00 pm CST every Monday (except when Monday is a holiday).

Knight-Ridder Financial News Service not only reports the export inspections over its wire services, but also surveys approximately five traders in each of the wheat, corn and soybean futures markets to obtain their expectations regarding export inspections for the week. These traders are selected based on their knowledge of cash market transactions. The survey generally is conducted each Monday between 10:00 am and 12:00 pm CST. At approximately 1:00 pm CST, Knight-Ridder releases the range of the expectations over its wire service. The proxy for the market's expectation is taken as the midpoint of the range of the survey expectations.

Data for weekly exports of wheat, corn and soybeans as well as expectations of traders regarding these reports are collected for the years

1988 through 1991. The sample therefore contains 208 potential observations.[2] Closing wheat, corn and soybean futures prices are collected for the days on which export inspections are released over the sample period. In addition, opening and closing futures prices are collected for each trading day following the release of the inspections. Contracts with a near term to expiration (one to two months) are examined. These contracts are selected because export inspections are reflections of the pace of export activity. In contrast, the Export Sales Report is primarily concerned with the level of exports. Consequently, the informational impact of the Export Inspections Report should be focused on the nearby contract.

Following standard procedure, the nearby contract is rolled to the next nearby contract just prior to the beginning of the delivery month. This procedure avoids potential pricing problems that might occur during the delivery month.

Properties of Expectations Data

Expectations should satisfy two rational properties (Muth). First, expectations should be unbiased predictors, and second, expectation errors should be uncorrelated. If errors are correlated, information in previous forecast errors is not incorporated into current expectations. These two rationality characteristics are examined using the following regression framework:

$$(1)\quad WHEAT_t = \beta_0 + \beta_1 WHEAT_t^e + \mu_t,$$

$$(2)\quad CORN_t = \beta_0 + \beta_1 CORN_t^e + \mu_t, \text{ and}$$

$$(3)\quad BEANS_t = \beta_0 + \beta_1 BEANS_t^e + \mu_t$$

where: WHEAT = weekly exports of wheat,

CORN = weekly exports of corn,

BEANS = weekly exports of soybeans

e = expected information (absence of e indicates actual export inspections),

t = report release date, and

μ_t = error term.

If expectations are unbiased, $\beta_0 = 0$ and $\beta_1 = 1$. An F-test is used to test the joint hypothesis that $\beta_0 = 0$ and $\beta_1 = 1$. The regression Durbin-Watson statistic is used to test whether forecast errors are uncorrelated.

Unbiasedness is rejected for both wheat and corn, because constants are significantly greater than zero and slopes are significantly less than one (Table 1). In contrast, unbiasedness is not rejected for soybeans. For all three commodities, Durbin-Watson statistics indicate that the error terms, or forecast errors, are not first-order autocorrelated. Thus, the surveyed traders correct for previous forecast errors in making their current forecast.

The results indicate that the soybean expectations can be used without adjustment, but the wheat and corn expectations are biased. However, Runkle notes that the predicted (fitted) values of regressions (1) and (2) are unbiased expectations. These adjusted wheat and corn expectations are used in all price reaction regressions in the remainder of the article.[3]

FUTURES PRICE REACTIONS TO THE EXPORT INSPECTIONS REPORT

Anticipated Information

In an efficient market, all available information, including anticipated information, is reflected in price. Therefore, futures prices should not respond to the expectations of export inspections because they are anticipated information. This hypothesis can be tested by regressing price changes on expected wheat, corn and soybean exports as follows:

$$(4) \quad \ln FP^{w}_{t+1}(O) - \ln FP^{w}_{t}(C) = \beta_0 + \beta_1(WHEAT^{e}_{t}) + \mu_t,$$

$$(5) \quad \ln FP^{c}_{t+1}(O) - \ln FP^{c}_{t}(C) = \beta_0 + \beta_1(CORN^{e}_{t}) + \mu_t, \text{ and}$$

$$(6) \quad \ln FP^{s}_{t+1}(O) - \ln FP^{s}_{t}(C) = \beta_0 + \beta_1(BEANS^{e}_{t}) + \mu_t$$

where FP^{i}_{t} denotes the nearby futures price (dollars per bushel) for commodity i (w = wheat, c = corn and s = soybeans) at time t, C denotes the close of trade, O denotes the open of trade, and the superscripted e denotes the expectations as proxied by the midpoint of the range of the survey data for soybeans and the adjusted midpoint for corn and wheat.[4] Note that the report is released on date t.

The price change is from the close of trade on the day of the report to the open of trade the following day. This "immediate" price change is used because, in an efficient market, prices respond to new information quickly. White's variance-covariance matrix estimator is used to correct for heteroskedasticity, a characteristic of futures price changes (Hall, Brorsen and Irwin).

None of the coefficient estimates are significantly different from zero at the ten-percent level (Table 2). This finding suggests that prices do not respond to the information which the market anticipates will be reported in

the Export Inspections Report. In this sense, information anticipated to be in the report already is incorporated into prices.

Unanticipated Information

According to the efficient markets hypothesis, prices should respond to the information contained in the Export Inspections Report only if the information is unanticipated (i.e. new) and market participants deem the information to be of value. Therefore, to examine whether the reports provide new information, the following regression equations are estimated:

$$(7) \quad \ln FP^{w}_{t+1}(O) - \ln FP^{w}_{t}(C) = \beta_0 + \beta_1(WHEAT_t - WHEAT^{e}_{t}) + \mu_t,$$

$$(8) \quad \ln FP^{c}_{t+1}(O) - \ln FP^{c}_{t}(C) = \beta_0 + \beta_1(CORN_t - CORN^{e}_{t}) + \mu_t, \text{ and}$$

$$(9) \quad \ln FP^{s}_{t+1}(O) - \ln FP^{s}_{t}(C) = \beta_0 + \beta_1(BEANS_t - BEANS^{e}_{t}) + \mu_t$$

where all terms are as defined earlier. The difference between the actual and expected inspections proxy the amount of unanticipated information contained in the Export Inspections Report.[5]

If the exports of a commodity are greater than expected, the futures price of that commodity should rise to reflect the fact that demand is larger than expected. The opposite should hold if exports are lower than expected. Therefore, the signs of the estimated coefficients for the own-price effects of unanticipated information should be positive. Again, White's variance-covariance matrix estimator is used to correct for heteroskedasticity.

Results are presented in Table 3. All of the slope coefficients for equations 7 through 9 are positive, as expected (Table 3). However, the slope coefficients for wheat and corn are not significantly greater than zero at the

ten-percent level. The slope parameter for soybeans is greater than zero at the one-percent level. These results suggest that the Export Inspections Report provides valuable information only to the soybean market.

Several possible explanations for the differing results across the commodities are investigated. The first is the presence of measurement error in the expectations data. Since the analysts' expectations serve as proxies for the true expectations, measurement error could be substantial. This may be especially relevant for wheat and corn because adjusted expectations are used in the price reaction equations. It is well-known that measurement error causes a downward bias in OLS slope coefficients (e.g Pindyck and Rubinfeld, p.161).

Hausman develops a test for measurement error.[6] To perform the test, instruments (Z_1) for the expectations need to be defined. Following Bauer and Orazem, the previous week's export inspections and the change in futures prices between reports are used as instruments. In the first step, the expectation is regressed on the two instruments as follows:

$$(10)\quad WHEAT^e_t = \alpha_0 + \alpha_1 WHEAT_{t-7} + \alpha_2[\ln FP^w_t(C) - \ln FP^w_{t-6}(O)] + \nu^w_t,$$

$$(11)\quad CORN^e_t = \alpha_0 + \alpha_1 CORN_{t-7} + \alpha_2[\ln FP^c_t(C) - \ln FP^c_{t-6}(O)] + \nu^c_t, \text{ and}$$

$$(12)\quad BEANS^e_t = \alpha_0 + \alpha_1 BEANS_{t-7} + \alpha_2[\ln FP^s_t(C) - \ln FP^s_{t-6}(O)] + \nu^s_t$$

where FP indicates futures price, superscripts w, c and s represent wheat, corn and soybeans, respectively, ν is the error term, t is the current Monday, t-7 is the previous Monday, t-6 is the previous Tuesday.

The second step is to include the estimated residuals from the above equations in the price reaction equations as follows:

$$(13)\ \ln FP^{w}_{t+1}(O) - \ln FP^{w}_{t}(C) = \beta_0 + \beta_1(WHEAT_t - WHEAT^{e}_{t}) + \beta_2\hat{\nu}^{w}_{t} + \epsilon_t,$$

$$(14)\ \ln FP^{c}_{t+1}(O) - \ln FP^{c}_{t}(C) = \beta_0 + \beta_1(CORN_t - CORN^{e}_{t}) + \beta_2\hat{\nu}^{c}_{t} + \epsilon_t, \text{ and}$$

$$(15)\ \ln FP^{s}_{t+1}(O) - \ln FP^{s}_{t}(C) = \beta_0 + \beta_1(BEANS_t - BEANS^{e}_{t}) + \beta_2\hat{\nu}^{s}_{t} + \epsilon_t.$$

The test for measurement error is whether β_2 is significantly different from zero. The estimated β_2's are not different from zero, suggesting that the expectations are not measured with significant error (Table 4). Therefore, measurement error can not explain the differing results across the three commodities.

A second potential explanation is that the price reaction in the wheat and corn markets is not instantaneous, as it appears to be in the soybeans. To test this hypothesis, the dependent variables in regressions 7-9 are replaced with the price change measured from the close on the day of the report release to the close on the following day. Allowing the longer time for price reaction did not alter the results significantly.[7] Hence, differences in reaction time do not explain the results across commodities.

A third possible explanation is that market conditions influence the price reactions to the report. For example, seasonal factors may cause the Export Inspections Report to have a greater impact on markets at certain times of the year. To test the hypothesis of seasonal factors affecting the report's effect, monthly dummy variables are added to equations 7-9. The dummy variables are not significant, suggesting that seasonality does not explain the differences observed among the markets.[8]

The effect of market conditions is also tested by dividing the sample into marketing years. The marketing year for wheat begins on June 1, while the marketing year for corn and soybeans begins on September 1. Coefficient estimates for wheat are not significant during any marketing year, confirming earlier results (Table 5). For corn, the coefficients are significant for the 1989/1990 and 1991/1992 marketing years, indicating the report provided valuable news at least during these marketing years. Interestingly, coefficients for soybeans are significant only during the 1988/1989 and 1990/1991 marketing years. These results suggest price reactions are conditioned by market fundamentals. Further, the marketing year analysis suggest the Export Inspections Report provides new information to the corn market as well as the soybean market, but, as with soybeans, only during two of the five marketing years.

SUMMARY AND CONCLUSIONS

This research analyzes the effects of USDA's weekly report of wheat, corn and soybeans export inspections upon wheat, corn and soybean futures prices in order to determine if the information contained in the report has value to the market. The research used survey data, collected by Knight-Ridder, to proxy market expectations of the information contained in the Export Inspections Report.

Results indicated that price changes are not explained by expected exports as proxied by the survey data, showing that anticipated information is reflected in prices. Wheat futures prices did not react to the unanticipated information in the report, while corn and soybean futures prices reacted significantly to unanticipated information only during two of the five

marketing years contained within the study period. This finding is similar to Patterson and Brorsen's finding of only limited price impact of the Export Sales Report.

The combined results of these two studies suggest that the Export Sales Report and Export Inspections Report provide only limited information to the market. Because large export sales must be announced within 24 hours of the actual sale, a significant proportion of export sales are publicly announced in advance of their inclusion in the Export Sales Report. Thus, the Export Sales Report and Export Inspections Report may be largely redundant components of the export reporting system. Confirmation of this conclusion requires an investigation of the information content of the release of large export sales. In addition, it would be desirable to conduct an analysis of the three components of the export reporting system over a comparable period and a variety of market conditions.

ENDNOTES

1. For a detailed discussion of the reporting limits on large sales and the Export Sales Report see Patterson and Brorsen.

2. Data is missing for 12 of the 208 observation points. The missing observations are scattered throughout the sample period, and, therefore, should not affect the empirical results.

3. Price reaction results reported in the next section are not sensitive to this assumption. All price reaction regressions for wheat and corn also are estimated using the unadjusted expectations. Results are qualitatively similar to regressions based on the adjusted survey expectations.

4. In additional research, the traders' expected value of export inspections for all three commodities are included as explanatory variables in each regression in order to assess if cross-price effects exist. No significant cross-price effects were evident. Therefore, only own-price effects are reported.

5. In additional research, the unanticipated export inspections for all three commodities are included as explanatory variables in each regression in order to assess whether cross-price effects exist. No significant cross-price effects were evident. Therefore, only own-price effects are reported.

6. A thorough explanation of Hausman's test for measurement error is found in Pindyck and rubinfeld (pp. 174-177).

7. These results are available from the authors upon request.

8. These results are available from the authors upon request.

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Table 1. Rationality Test of Market Traders' Survey Data Regarding USDA's Export Inspections Report, 1988-1991

Variable	Commodity[a]		
	Wheat	Corn	Soybeans
Constant	6.691***	7.174***	0.404
	(1.475)	(2.057)	(0.422)
Midpoint of Analyst's Range	0.740***	0.820***	1.000
	(0.060)	(0.054)	(0.034)
Summary Statistics:			
Adj. R^2	0.436	0.538	0.813
D.W.	1.955	2.050	2.134
F-Bias[b]	10.296***	6.119***	2.237

Significance at the ten, five, and one percent level is indicated by *, **, and ***, respectively.

[a]Standard errors appear in parentheses below the estimated coefficients. The null hypotheses are that (1) intercept equals zero and (2) slope equal one.

[b]F-Bias is the F-statistic for the joint null hypothesis that intercept equals zero and slope equals one.

Table 2. Response of Wheat, Corn, and Soybean Futures Prices to Anticipated U.S. Export Inspections Report Information, 1988-1991

	Commodity[a]		
Variable	Wheat	Corn	Soybeans
Constant	0.1030 (0.1780)	0.1954 (0.3249)	0.1837 (0.1992)
Anticipated Information	-0.0041 (0.0062)	-0.0034 (0.0074)	-0.0150 (0.0117)
Summary Statistics:			
Adj. R^2	-0.0038	-0.0044	0.0004
D-W	1.7913	2.0690	1.9771

Significance at the ten, five, and one percent level is indicated by *, **, and ***, respectively.

[a]Note: Standard errors appear in parentheses below the estimated coefficients.

Table 3. Response of Wheat, Corn and Soybean Futures Prices to Unanticipated Information in USDA's Export Inspections Report, 1988-1991

	Commodity[a]		
Variable	Wheat	Corn	Soybeans
Constant	0.0091	0.0693	-0.0060
	(0.0466)	(0.0714)	(0.0739)
Unanticipated Information	0.0016	0.0014	0.0051***
	(0.0017)	(0.0020)	(0.0024)
Summary Statistics:			
Adj. R^2	-0.0009	-0.0044	0.0118
D-W	1.7765	2.0680	1.9565

Significance at the ten, five, and one percent level is indicated by *, **, and ***, respectively.

[a]Standard errors appear in parentheses below the respective estimated coefficients. One-sided tests are performed on the slope coefficient estimates.

Table 4. Tests for Measurement Error in Market Trader's Survey Data Regarding USDA's Export Inspections Report, 1988 - 1991

Variable	Commodity[a]		
	Wheat	Corn	Soybeans
Constant	0.0087	0.0685	-0.0061
	(0.0465)	(0.0706)	(0.0745)
Unanticipated Information	0.0017	0.0009	0.0050**
	(0.0017)	(0.0020)	(0.0024)
Residual (ν)	0.0074	-0.0118	-0.0056
	(0.0111)	(0.0149)	(0.0173)
Summary Statistics:			
Adj. R^2	-0.0048	-0.0071	0.0067
D.W.	1.7695	2.0727	1.9563

Significance at the ten, five, and one percent level is indicated by *, **, and ***, respectively.

[a]Standard errors appear in parentheses below the estimated coefficients. The null hypotheses is that the estimated coefficient for "Residual" equals zero.

Table 5. Response of Wheat, Corn and Soybean Futures Prices to Unanticipated Information in USDA's Export Inspections Report by Marketing Years, 1988-1991.

Variable by Marketing Year	Commodity[a]		
	Wheat	Corn	Soybeans
----------1987/1988 Marketing Year----------			
Constant	-0.0134	0.1307	-0.0346
	(0.0886)	(0.3191)	(0.2638)
Unanticipated Information	-0.0022	-0.0055	0.0065
	(0.0047)	(0.0091)	(0.0143)
Summary Statistics:			
Adj. R^2	-0.0421	-0.0285	-0.0237
D-W	2.5821	2.2845	2.2808
Nos. Observations	23	34	34
----------1988/1989 Marketing Year----------			
Constant	-0.0642	0.0907	0.0526
	(0.0888)	(0.1019)	(0.0899)
Unanticipated Information	0.0036	0.0014	0.0077***
	(0.0055)	(0.0043)	(0.0031)
Summary Statistics:			
Adj. R^2	-0.0066	-0.0197	0.1015
D-W	1.6649	1.8150	2.1276
Nos. Observations	48	50	50
----------1989/1990 Marketing Year--------			
Constant	0.0059	-0.0135	-0.0328
	(0.0602)	(0.0405)	(0.0416)
Unanticipated Information	0.0030	0.0053***	0.0012
	(0.0025)	(0.0019)	(0.0015)
Summary Statistics:			
Adj. R^2	0.0111	0.0688	-0.0055
D-W	1.7627	2.2951	1.4920
Nos. Observations	50	50	50

continued

Table 5. continued

Variable	Commodity[a] Wheat	Corn	Soybeans
----------1990/1991 Marketing Year---------			
Constant	-0.0309	0.0736	-0.0734
	(0.0473)	(0.1223)	(0.4894)
Unanticipated Information	0.0015	0.0005	0.0080*
	(0.0015)	(0.0023)	(0.0049)
Summary Statistics:			
Adj. R^2	-0.0033	-0.0221	0.0000
D-W	1.5446	1.4249	1.5338
Nos. Observations	48	47	47
----------1991/1992 Marketing Year--------			
Constant	0.2565	0.1504	0.0617
	(0.2507)	(0.1038)	(0.1061)
Unanticipated Information	-0.0000	0.0061***	-0.0003
	(0.0067)	(0.0027)	(0.0053)
Summary Statistics:			
Adj. R^2	-0.0400	0.0416	-0.0765
D-W	1.8981	2.8233	2.0139
Nos. Observations	27	15	15

Significance at the ten, five, and one percent level is indicated by *, **, and ***, respectively.

[a]Standard errors appear in parentheses below the respective estimated coefficients. One-sided tests are performed on the slope coefficient estimates.